



## Course Specification of Digital Image Processing

I. Course Identification and General Information:					
1.	Course Title:	Digital Image Processing			
2.	Course Code & Number:	CCE427			
3.	Credit hours:	C.H			Total
		Th.	Tu.	Pr.	
		2	-	2	-
4.	Study level/ semester at which this course is offered:	5 <sup>th</sup> level (final)/ First Semester			
5.	Pre –requisite (if any):	Digital Signal Processing (CCE333) & Programming Language 1 (Python) (CCE141)			
6.	Co –requisite (if any):	N/A			
7.	Program (s) in which the course is offered:	Computer Engineering & Control			
8.	Language of teaching the course:	English			
9.	Location of teaching the course:	Education Building, 2 <sup>nd</sup> flour, Room 105			
10.	Prepared By:	Asst. prof. Dr. Ali AL-Hamdi			
11.	Date of Approval				

## II. Course Description:

This course aims to provide students with basic concepts, methods, algorithms, and technical tools applied in image processing and their applications to modern technologies like, AI, cameras and intelligent robot systems for industrial environment. The course covers the basic principles topics including fundamentals of image acquisition, intensity transformation and filtering, image compression, morphological pressing, and image segmentation that are based on mathematical models using computers and necessary software. Throughout computer-based lab and term-project, students develop IT-based problems-solving skills to enter the highly dynamic and rapidly developing software industry productively, and the ability to operate

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effectively in a professional environment, to make existing technologies more efficient, or to develop new algorithms.

III. Course Intended learning outcomes (CILOs) of the course		Referenced PILOs
<b>a1</b>	Define important terminologies related to digital image processing including intensity transformations and filtering, image compression, morphological image processing, mage segmentation, and tools used in image processing.	A1 and A2
<b>a2</b>	Discuss main operations and sub-operations of digital image processes in describing the associated algorithms used, the applications, and the advantages and disadvantages of each one.	A3 and A4
<b>b1</b>	Evaluate the qualitative performance and the complexity of the algorithms used in digital image processing.	B2, and B3
<b>b2</b>	Choose the appropriate algorithm for the appropriate application of digital image processing.	B4
<b>c1</b>	Design solutions regarding the aspects of digital image processing for any application.	C4
<b>c2</b>	Apply acquired knowledge and understanding in mathematics, algorithms, programing languages, and skills gained in this course to develop programs that process gray-level digital images.	C1 and C3
<b>d1</b>	Work effectively as individual or as a part of a team in applying knowledge and skills gained throughout the course to prepare mini reports associated with the aspects of image processing and its applications.	D1 and D2
<b>d2</b>	Communicate effectively orally and in written forms as individual or within a team working and discussing the different aspects of image processing and related applications.	D3 and D4

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**(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:**

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>a1-</b> Define important terminologies related to digital image processing including intensity transformations and filtering, image compression, morphological image processing, mage segmentation, and tools used in image processing.	<ul style="list-style-type: none"> <li>• Active Lectures,</li> <li>• Self-study, and</li> <li>• Interactive-Class Discussions</li> </ul>	<ul style="list-style-type: none"> <li>• Topic preparation and delivery,</li> <li>• Written Exams (Quizzes, midterm and final).</li> </ul>
<b>a2-</b> Discuss main operations and sub-operations of digital image processes in describing the associated algorithms used, the applications, and the advantages and disadvantages of each one.	<ul style="list-style-type: none"> <li>• Active Lectures,</li> <li>• Self-study, and</li> <li>• Interactive-Class Discussions</li> </ul>	<ul style="list-style-type: none"> <li>• Topic preparation and delivery,</li> <li>• Written Exams (Quizzes, midterm and final).</li> </ul>

**(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:**

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>b1-</b> Evaluate the qualitative performance and the complexity of the algorithms used in digital image processing.	<ul style="list-style-type: none"> <li>• Active Lectures,</li> <li>• Laboratory Sessions,</li> <li>• Self-study,</li> <li>• Interactive-Class Discussions,</li> <li>• Use of IT Tools.</li> </ul>	<ul style="list-style-type: none"> <li>• Topic preparation and delivery,</li> <li>• Written Exams (Quizzes, midterm and final).</li> </ul>
<b>b2-</b> Choose the appropriate algorithm for the appropriate application of digital image processing.	<ul style="list-style-type: none"> <li>• Active Lectures,</li> <li>• Laboratory Sessions,</li> <li>• Self-study,</li> </ul>	<ul style="list-style-type: none"> <li>• Topic preparation and delivery,</li> </ul>

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	<ul style="list-style-type: none"> <li>• Interactive-Class Discussions,</li> <li>• Use of IT Tools.</li> </ul>	<ul style="list-style-type: none"> <li>• Written Exams (Quizzes, midterm and final)</li> <li>• Lab &amp; project reports.</li> </ul>
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**© Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:**

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>c1-</b> Design solutions regarding the aspects of digital image processing for any application.	<ul style="list-style-type: none"> <li>• Laboratory sessions,</li> <li>• Projects.</li> </ul>	<ul style="list-style-type: none"> <li>• Lab &amp; project reports.</li> </ul>
<b>c2-</b> Apply acquired knowledge and understanding in mathematics, algorithms, programming languages, and skills gained in this course to develop programs that process gray-level digital images.	<ul style="list-style-type: none"> <li>• Laboratory sessions,</li> <li>• Projects</li> </ul>	<ul style="list-style-type: none"> <li>• Lab &amp; project reports.</li> </ul>

**(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:**

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>d1-</b> Work productively as individual or as a part of a team in applying knowledge and skills gained throughout the course to prepare mini reports associated with the aspects of image processing and its applications.	<ul style="list-style-type: none"> <li>• Interactive-Class Discussions, and</li> <li>• laboratory sessions.</li> </ul>	<ul style="list-style-type: none"> <li>• Topic preparation and delivery,</li> <li>• Lab &amp; project reports</li> </ul>
<b>d2-</b> Communicate effectively orally and in written forms as individual or within a	<ul style="list-style-type: none"> <li>• Interactive-Class Discussions, and</li> </ul>	<ul style="list-style-type: none"> <li>• Topic preparation and delivery,</li> </ul>

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team working and discussing the different aspects of image processing and related applications.	• laboratory sessions.	• Lab & project reports
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**IV. Course Content:**

A – Theoretical Aspect:					
Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1.	Course plan distribution and presentation	a1	<ul style="list-style-type: none"> <li>• Course Identification and General Information,</li> <li>• Course Description,</li> <li>• Intended learning outcomes (ILOs) of the course,</li> <li>• Course Content: theoretical and practical aspects,</li> <li>• Teaching strategies of the course,</li> <li>• Lab Assignments,</li> <li>• Assessment methods,</li> <li>• Learning Resources,</li> <li>• Course Policies.</li> </ul>	1	2
2.	Digital Image Fundamental	a1, a2, b1, and d2	<ul style="list-style-type: none"> <li>• Elements of Visual Perception,</li> <li>• Light and the Electromagnetic Spectrum,</li> <li>• Image Sensing and Acquisition,</li> <li>• Image Sampling and Quantization,</li> </ul>	3	6

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			<ul style="list-style-type: none"> <li>Some Basic Relationships between Pixels,</li> <li>An Introduction to Mathematical Tools used in DIP.</li> </ul>		
3.	Intensity Transformations and Spatial & Frequency Filtering	a1, a2, b1, and d2	<ul style="list-style-type: none"> <li>Preview,</li> <li>Background,</li> <li>Some basic Intensity Transformation functions,</li> <li>Histogram Processing,</li> <li>Fundamentals of Spatial Filtering,</li> <li>Spatial Smoothing Filters,</li> <li>Sharpening Spatial Filters.</li> <li>Frequency Domain Filtering, concepts, methodology and Techniques</li> </ul>	3	6
4.	Mid Term Exam	a1, a2, b1	<ul style="list-style-type: none"> <li>ALL Previous Topics</li> </ul>	1	2
5.	Image Compression	a1, a2, b1, and d2	<ul style="list-style-type: none"> <li>Preview &amp; Fundamentals on Compressions,</li> <li>Some Basic Compression Methods,</li> <li>Digital Image Watermarking.</li> </ul>	2	4
6.	Morphological Image Processing	a1, a2, b1, and d2	<ul style="list-style-type: none"> <li>Preview,</li> <li>Preliminaries,</li> <li>Erosion and Dilation,</li> <li>Opening and Closing,</li> <li>The Hit-or-Miss transformation,</li> </ul>	3	6

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			<ul style="list-style-type: none"> <li>Some Basic Morphological Algorithms,</li> <li>Gray-Scale Morphology.</li> </ul>		
7.	Image Segmentation	a1, a2, b2, and d2	<ul style="list-style-type: none"> <li>Fundamentals,</li> <li>Point, Line, and Edge detection,</li> <li>Thresholding,</li> <li>Region-based Segmentation.</li> </ul>	2	4
8.	Final Exam	a1, a2, b1, b2	<ul style="list-style-type: none"> <li>ALL Topics</li> </ul>	1	2
<b>Number of Weeks /and Units Per Semester:</b>				<b>16</b>	<b>32</b>

<b>B - Practical Aspect:</b>				
Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes
1.	<b>Introduction:</b> Presentation of lab topics, DIP tools used in the lab, and lab assignments.	1	2	a1
2.	<b>Arithmetic and logic Operations:</b> Averaging, Subtraction, Multiplication, Set Operation.	1	2	a1, a2, b1, c1, c2, and d1
3.	<b>Intensity Transformation functions:</b> Image Negatives, Log, Power-Law, Contrast stretching, Intensity-Level Slicing, Bit-Plane Slicing.	2	4	a1, a2, b1, c1, c2, and d1
4.	<b>Histogram Processing:</b> drawing image histogram, Histogram Equalization, Histogram Specification, Local Histogram Processing using statistics.	1.5	3	a1, a2, b1, c1, c2, and d1
5.	<b>Spatial Filtering:</b> Smoothing Linear Filters, Order-Static (Nonlinear) Filters, Sharpening Filters.	2.5	5	a1, a2, b1, c1, c2, and d1

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	<b>Frequency Domain Filtering and Image Compressions</b>			
6.	<b>Morphological Processing:</b> Erosion, Dilation, Opening and Closing, Boundary Extraction, Hole filling, Extraction of connected components, Opening by reconstruction, Border cleaning, Gray-level Erosion and dilation, Gray-level Opening and Closing, Morphological gradient, Top-hat and bottom-hat transformations, Dranulometry, Textural segmentation, Gray-level Textural segmentation	2	4	a1, a2,b1, c1, c2, and d1
7.	<b>Image Segmentation:</b> Detection of Isolated Points, Line Detection, Edges detection, Global Thresholding using Iterative Algorithm, Global Thresholding using Iterative Algorithm using Otsu's method, Optimum Global Thresholding Using Otsu's Method, Using Edge to Improve Global Thresholding, Multiple Thresholding, Region Growing, Region Splitting and Merging.	2	4	a1, a2, b1, c1, c2, and d1
8.	<b>Review</b>	1	2	a1, a2, b1, b2, c1, c2, d1& d2
9.	<b>Project Presentations (Students work in teams of 2 or 3 members since the 4<sup>th</sup> week)</b>	1	2	a1, a2, b1, b2, c1, c2, d1& d2
<b>Number of Weeks /and Units Per Semester</b>		<b>14</b>	<b>28</b>	

### V. Teaching strategies of the course:

- Active Lectures
- Participation
- Laboratory sessions (Computer-based),
- Home Works & Assignments,
- Use of IT Tools,

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- Projects,
- Self-study

## VI. Reports:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Mini lab reports of Arithmetic and logic Operations.	a1,a2,b1, c1, c2, and d1	2 <sup>rd</sup>	1
2.	Mini lab reports of Intensity Transformation functions .	a1,a2,b1, c1, c2, and d1	3 <sup>rd</sup>	2
3.	1 <sup>st</sup> mini lab report of Histogram Processing.	a1,a2,b1, c1, c2, and d1	4 <sup>th</sup>	1
4.	2 <sup>nd</sup> mini lab report of Histogram Processing.	a1,a2,b1, c1, c2, and d1	5 <sup>th</sup>	1
5.	1 <sup>st</sup> mini lab report of Spatial Filtering.	a1,a2,b1, c1, c2, and d1	6 <sup>th</sup>	1
6.	2 <sup>nd</sup> mini lab report of Spatial Filtering.	a1,a2,b1, c1, c2, and d1	7 <sup>th</sup>	1
7.	1 <sup>st</sup> mini lab report of Morphological Processing	a1,a2,b1, c1, c2, and d1	8 <sup>th</sup>	1
8.	2 <sup>nd</sup> mini lab report of Morphological Processing	a1,a2,b1, c1, c2, and d1	9 <sup>th</sup>	1
9.	3 <sup>rd</sup> mini lab report of Morphological Processing.	a1,a2,b1, c1, c2, and d1	10 <sup>th</sup>	1
10.	1 <sup>st</sup> mini lab report of Image segmentation.	a1,a2,b1, c1, c2, and d1	11 <sup>th</sup>	1
11.	2 <sup>nd</sup> mini lab report of Image segmentation.	a1,a2,b1, c1, c2, and d1	12 <sup>th</sup>	1
12.	3 <sup>rd</sup> mini lab report of Image segmentation	a1,a2,b1, c1, c2, and d1	13 <sup>th</sup>	1
13.	4 <sup>th</sup> mini lab report of Image segmentation	a1,a2,b1, c1, c2, and d1	11 <sup>th</sup>	1
14.	5 <sup>th</sup> mini lab report of Image segmentation	a1,a2,b1, c1, c2, and d1	End of 14 <sup>th</sup>	1
<b>Total</b>				<b>15</b>

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VII. Schedule of Assessment Tasks for Students During the Semester:					
No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Assignments & Reports and Topic preparation and delivery & participation	2 <sup>nd</sup> to 15 <sup>th</sup>	22.5	15%	a1, a2, b1, b2, c1, c2, d1, d2
2.	Quizzes	5 <sup>th</sup> , 10 <sup>th</sup> & 14 <sup>th</sup>	7.5	5%	a1, and a2
3.	Midterm Exam (Theory)	8 <sup>th</sup>	15	10%	a1, a2, b1
4.	Final Lab Exam (including Term-Project Evaluation)	14 <sup>th</sup> & 15 <sup>th</sup>	30	20%	a1, a2, b1, b2, c1, c2, d1, & d2
5.	Final Exam (Theory)	16 <sup>th</sup>	75	50%	a1, a2, b1, b2
<b>Total</b>			<b>150</b>	<b>100%</b>	

VIII. Learning Resources:	
<ul style="list-style-type: none"> <li>Written in the following order: ( Author - Year of publication – Title – Edition – Place of publication – Publisher).</li> </ul>	
<b>1- Required Textbook(s) ( maximum two ).</b>	
	1- Rafael C. Gonzalez, Richard E. Woods 2017, Digital Image Processing, 4 <sup>th</sup> edition, Pearson. 2- Rafael C. Gonzalez, Richard E. Woods, 2008, Digital Image Processing, 3rd edition, Prentice Hall. 3- Stan Birchfield, 2017, Image Processing and Analysis, 1 <sup>st</sup> edition,
<b>2- Essential References.</b>	
	1. Rafael C. Gonzalez, 2008, Digital Image Processing, 3rd edition, Prentice Hall.
<b>3- Electronic Materials and Web Sites etc.</b>	

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<p>1- <a href="http://www.prenhall.com/gonzalezwoods">www.prenhall.com/gonzalezwoods</a>                  2- <a href="http://www.imageprocessingplace.com">www.imageprocessingplace.com</a>                  3- If additional websites are required, they will be submitted to the students during the semester. The addresses of those websites will be indicated in the handouts.</p>
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## IX. Course Policies:

<b>1.</b>	<p><b>Class Attendance:</b>                  -A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic</p>
<b>2.</b>	<p><b>Tardy:</b>                  - For late in attending the class, the student will be initially notified. If he repeated lateness in attending class he will be considered as absent.</p>
<b>3.</b>	<p><b>Exam Attendance/Punctuality:</b>                  - A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam.</p>
<b>4.</b>	<p><b>Assignments &amp; Projects:</b>                  - The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time.</p>
<b>5.</b>	<p><b>Cheating:</b>                  - For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.</p>
<b>6.</b>	<p><b>Plagiarism:</b>                  Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university.</p>

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7.	<p><b>Other policies:</b></p> <ul style="list-style-type: none"> <li>- Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise the student will be asked to leave the lecture room</li> <li>- Mobile phones are not allowed in class during the examination.</li> </ul> <p>Lecture notes and assignments my given directly to students using soft or hard copy</p>
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<b>Reviewed By</b>	<p><b><u>Vice Dean for Academic Affairs and Post Graduate Studies: Asst. Prof. Dr. Tarek A. Barakat</u></b></p> <p><b><u>President of Quality Assurance Unit: Assoc. Prof. Dr. Mohammed Algorafi</u></b></p> <p><b><u>Name of Reviewer from the Department: Assoc. Prof. Dr. Farouk Al-Fuhaidy</u></b></p>
	<p><b><u>Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa</u></b></p> <p><b><u>Assoc. Prof. Dr. Ahmed Mujahed</u></b></p> <p><b><u>Asst. Prof. Dr. Munasar Alsubri</u></b></p>

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## Template for Course Plan of Software Engineering

I. Information about Faculty Member Responsible for the Course:								
Name of Faculty Member	Asst. prof. Dr. Ali AL-Hamdi		Office Hours					
Location & Telephone No.	Electrical department building		SA	SU	MO	TU	WE	TH
E-mail	<a href="mailto:aalhamdi1989@gmail.com">aalhamdi1989@gmail.com</a>			12-14				12-14

II. Course Identification and General Information:						
1-	Course Title:	Digital Image Processing				
2-	Course Number & Code:	CCE427				
3-	Credit hours: 4	C.H			Total	
		Th.	Tu.	Pr.		Tr.
		2	-	2	-	3
4-	Study level/year at which this course is offered:	5 <sup>th</sup> level (final)/ 1 <sup>st</sup> Semester				
5-	Pre –requisite (if any):	Digital Signal Processing (CCE333) & Programming Language 1 (Python) (CCE141)				
6-	Co –requisite (if any):	None.				
7-	Program (s) in which the course is offered	Computer Engineering & Control				
8-	Language of teaching the course:	English				
9-	System of Study:	Semester				
10-	Mode of delivery:	Collective and individual learning				
11-	Location of teaching the course:	Education Building, Electrical Eng. Dept.				

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### III. Course Description:

This course aims to provide students with basic concepts, methods, algorithms, and technical tools applied in image processing and their applications to modern technologies like, AI, cameras and intelligent robot systems for industrial environment. The course covers the basic principles topics including fundamentals of image acquisition, intensity transformation and filtering, image compression, morphological pressing, and image segmentation that are based on mathematical models using computers and necessary software. Throughout computer-based lab and term-project, students develop IT-based problems-solving skills to enter the highly dynamic and rapidly developing software industry productively, and the ability to operate effectively in a professional environment, to make existing technologies more efficient, or to develop new algorithms.

### IV. Intended learning outcomes (ILOs) of the course:

- Brief summary of the knowledge or skill the course is intended to develop:
  - 1- Define important terminologies related to digital image processing including intensity transformations and filtering, image compression, morphological image processing, mage segmentation, and tools used in image processing.
  - 2- Discuss main operations and sub-operations of digital image processes in describing the associated algorithms used, the applications, and the advantages and disadvantages of each one.
  - 3- Evaluate the qualitative performance and the complexity of the algorithms used in digital image processing.
  - 4- Choose the appropriate algorithm for the appropriate application of digital image processing.
  - 5- Design solutions regarding the aspects of digital image processing for any application.
  - 6- Apply acquired knowledge and understanding in mathematics, algorithms, programing languages, and skills gained in this course to develop programs that process gray-level digital images.
  - 7- Work effectively as individual or as a part of a team in applying knowledge and skills gained throughout the course to prepare mini reports associated with the aspects of image processing and its applications.

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8- Communicate effectively orally and in written forms as individual or within a team working and discussing the different aspects of image processing and related applications.

**V.Course Content:**

- Distribution of Semester Weekly Plan of Course Topics/Items and Activities.

**A – Theoretical Aspect:**

Order	Topics List	Sub Topics List	Week Due	Contact Hours
1.	Course plan distribution and presentation	<ul style="list-style-type: none"> <li>• Course Identification and General Information,</li> <li>• Course Description,</li> <li>• Intended learning outcomes (ILOs) of the course,</li> <li>• Course Content: theoretical and practical aspects,</li> <li>• Teaching strategies of the course,</li> <li>• Lab Assignments,</li> <li>• Assessment methods,</li> <li>• Learning Resources,</li> <li>• Course Policies.</li> </ul>	1 <sup>st</sup>	2
2.	Digital Image Fundamental	<ul style="list-style-type: none"> <li>• Elements of Visual Perception,</li> <li>• Light and the Electromagnetic Spectrum,</li> <li>• Image Sensing and Acquisition,</li> <li>• Image Sampling and Quantization,</li> <li>• Some Basic Relationships between Pixels,</li> <li>• An Introduction to Mathematical Tools used in DIP.</li> </ul>	2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup>	6
3.	Intensity Transformations	<ul style="list-style-type: none"> <li>• Preview,</li> <li>• Background,</li> </ul>	5 <sup>th</sup> , 6 <sup>th</sup> , 7 <sup>th</sup>	6

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	and Spatial & Frequency Filtering	<ul style="list-style-type: none"> <li>• Some basic Intensity Transformation functions,</li> <li>• Histogram Processing,</li> <li>• Fundamentals of Spatial Filtering,</li> <li>• Spatial Smoothing Filters,</li> <li>• Sharpening Spatial Filters.</li> <li>• Frequency Domain Filtering, concepts, methodology and Techniques</li> </ul>		
4.	Mid Term Exam	<ul style="list-style-type: none"> <li>• ALL Previous Topics</li> </ul>	8 <sup>th</sup>	2
5.	Image Compression	<ul style="list-style-type: none"> <li>• Preview &amp; Fundamentals on Compressions,</li> <li>• Some Basic Compression Methods,</li> <li>• Digital Image Watermarking.</li> </ul>	9 <sup>th</sup> , 10 <sup>th</sup>	4
6.	Morphological Image Processing	<ul style="list-style-type: none"> <li>• Preview,</li> <li>• Preliminaries,</li> <li>• Erosion and Dilation,</li> <li>• Opening and Closing,</li> <li>• The Hit-or-Miss transformation,</li> <li>• Some Basic Morphological Algorithms,</li> <li>• Gray-Scale Morphology.</li> </ul>	11 <sup>th</sup> , 12 <sup>th</sup> , 13 <sup>th</sup>	6
7.	Image Segmentation	<ul style="list-style-type: none"> <li>• Fundamentals,</li> <li>• Point, Line, and Edge detection,</li> <li>• Thresholding,</li> <li>• Region-based Segmentation.</li> </ul>	14 <sup>th</sup> , 15 <sup>th</sup>	4
8.	Final Exam	<ul style="list-style-type: none"> <li>• ALL Topics</li> </ul>	16 <sup>th</sup>	2
<b>Number of Weeks /and Units Per Semester</b>			<b>16</b>	<b>32</b>

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<b>B – Practical Aspect:</b>			
<b>Order</b>	<b>Topics List</b>	<b>Week Due</b>	<b>Contact Hours</b>
1.	<b>Introduction:</b> Presentation of lab topics, DIP tools used in the lab, and lab assignments.	1 <sup>st</sup>	2
2.	<b>Arithmetic and logic Operations:</b> Averaging, Subtraction, Multiplication, Set Operation.	2 <sup>nd</sup>	2
3.	<b>Intensity Transformation functions:</b> Image Negatives, Log, Power-Law, Contrast stretching, Intensity-Level Slicing, Bit-Plane Slicing.	3 <sup>rd</sup> , 4 <sup>th</sup>	4
4.	<b>Histogram Processing:</b> drawing image histogram, Histogram Equalization, Histogram Specification, Local Histogram Processing using statistics.	5 <sup>th</sup> , 6 <sup>th</sup>	3
5.	<b>Spatial Filtering:</b> Smoothing Linear Filters, Order-Static (Nonlinear) Filters, Sharpening Filters. <b>Frequency Domain Filtering and Image Compressions</b>	6 <sup>th</sup> , 7 <sup>th</sup> , 8 <sup>th</sup>	5
6.	<b>Morphological Processing:</b> Erosion, Dilation, Opening and Closing, Boundary Extraction, Hole filling, Extraction of connected components, Opening by reconstruction, Border cleaning, Gray-level Erosion and dilation, Gray-level Opening and Closing, Morphological gradient, Top-hat and bottom-hat transformations, Dranulometry, Textural segmentation, Gray-level Textural segmentation	9 <sup>th</sup> , 10 <sup>th</sup>	4
7.	<b>Image Segmentation:</b> Detection of Isolated Points, Line Detection, Edges detection, Global Thresholding using Iterative Algorithm, Global Thresholding using Iterative Algorithm using Otsu's method, Optimum Global Thresholding Using Otsu's Method, Using Edge to Improve Global Thresholding, Multiple Thresholding, Region Growing, Region Splitting and Merging.	11 <sup>th</sup> , 12 <sup>th</sup>	4

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8.	Review	13 <sup>th</sup>	2
9.	Project Presentations (Students work in teams of 2 or 3 members since the 4 <sup>th</sup> week)	14 <sup>th</sup>	2
9.	Final Lab Exam	15 <sup>th</sup>	2
Number of Weeks /and Units Per Semester:		15	30

VI. Teaching strategies of the course:	
<ul style="list-style-type: none"> <li>• Active Lectures</li> <li>• Participation</li> <li>• Laboratory sessions (Computer-based),</li> <li>• Home Works &amp; Assignments,</li> <li>• Use of IT Tools,</li> <li>• Projects,</li> <li>• Self-study</li> </ul>	

VII. Reports:			
No	Assignments	Week Due	Mark
1.	Mini lab reports of Arithmetic and logic Operations.	2 <sup>rd</sup>	1
2.	Mini lab reports of Intensity Transformation functions .	3 <sup>rd</sup>	2
3.	1 <sup>st</sup> mini lab report of Histogram Processing.	4 <sup>th</sup>	1
4.	2 <sup>nd</sup> mini lab report of Histogram Processing.	5 <sup>th</sup>	1
5.	1 <sup>st</sup> mini lab report of Spatial Filtering.	6 <sup>th</sup>	1
6.	2 <sup>nd</sup> mini lab report of Spatial Filtering.	7 <sup>th</sup>	1
7.	1 <sup>st</sup> mini lab report of Morphological Processing	8 <sup>th</sup>	1

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8.	2 <sup>nd</sup> mini lab report of Morphological Processing	9 <sup>th</sup>	1
9.	3 <sup>rd</sup> mini lab report of Morphological Processing.	10 <sup>th</sup>	1
10.	1 <sup>st</sup> mini lab report of Image segmentation.	11 <sup>th</sup>	1
11.	2 <sup>nd</sup> mini lab report of Image segmentation.	12 <sup>th</sup>	1
12.	3 <sup>rd</sup> mini lab report of Image segmentation	13 <sup>th</sup>	1
13.	4 <sup>th</sup> mini lab report of Image segmentation	11 <sup>th</sup>	1
14.	5 <sup>th</sup> mini lab report of Image segmentation	End of 14 <sup>th</sup>	1
<b>Total</b>			<b>15</b>

### VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1.	Assignments & Reports and Topic preparation and delivery & participation	2 <sup>nd</sup> to 15 <sup>th</sup>	20	15%
2.	Quizzes	5 <sup>th</sup> , 10 <sup>th</sup> & 14 <sup>th</sup>	10	5%
3.	Midterm Exam (Theory)	8 <sup>th</sup>	15	10%
4.	Final Lab Exam (including Term-Project Evaluation)	14 <sup>th</sup> & 15 <sup>th</sup>	30	20%
5.	Final Exam (Theory)	16 <sup>th</sup>	75	50%
<b>Total Marks / Percentage</b>			<b>150</b>	<b>100%</b>

### X. Learning Resources:

- *Written in the following order: ( Author - Year of publication – Title – Edition – Place of publication – Publisher).*

#### 1- Required Textbook(s) ( maximum two ).

- 4- Rafael C. Gonzalez, Richard E. Woods 2017, Digital Image Processing, 4<sup>th</sup> edition, Pearson.
- 5- Rafael C. Gonzalez, Richard E. Woods, 2008, Digital Image Processing, 3rd edition, Prentice Hall.

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	6- Stan Birchfield, 2017, Image Processing and Analysis, 1 <sup>st</sup> edition,
<b>2- Essential References.</b>	
	2. Rafael C. Gonzalez, 2008, Digital Image Processing, 3rd edition, Prentice Hall.
<b>3- Electronic Materials and Web Sites etc.</b>	
	4- <a href="http://www.prenhall.com/gonzalezwoods">www.prenhall.com/gonzalezwoods</a> 5- <a href="http://www.imageprocessingplace.com">www.imageprocessingplace.com</a> 6- If additional websites are required, they will be submitted to the students during the semester. The addresses of those websites will be indicated in the handouts.

<b>XI. Course Policies:</b>	
<b>1.</b>	<b>Class Attendance:</b> -A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic
<b>2.</b>	<b>Tardy:</b> - For late in attending the class, the student will be initially notified. If he repeated lateness in attending class he will be considered as absent.
<b>3.</b>	<b>Exam Attendance/Punctuality:</b> - A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam.
<b>4.</b>	<b>Assignments &amp; Projects:</b> - The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time.
<b>5.</b>	<b>Cheating:</b>

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	- For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.
6.	<b>Plagiarism:</b> Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university.
7.	<b>Other policies:</b> - Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise the student will be asked to leave the lecture room - Mobile phones are not allowed in class during the examination. Lecture notes and assignments my given directly to students using soft or hard copy

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